

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election with traverse of species in the reply filed on April 23, 2008 is acknowledged. The traversal is on the ground(s) that "third non-linear optical region" which is not shown in the drawing. This is not found persuasive because need another search and is another embodiment.

The requirement is still deemed proper and is therefore made FINAL.

### ***Priority***

The priority has been considered by the examiner.

### ***Information Disclosure Statement***

The references cited in the Information Disclosure Statement (IDS) have been considered by the examiner.

### ***Drawings***

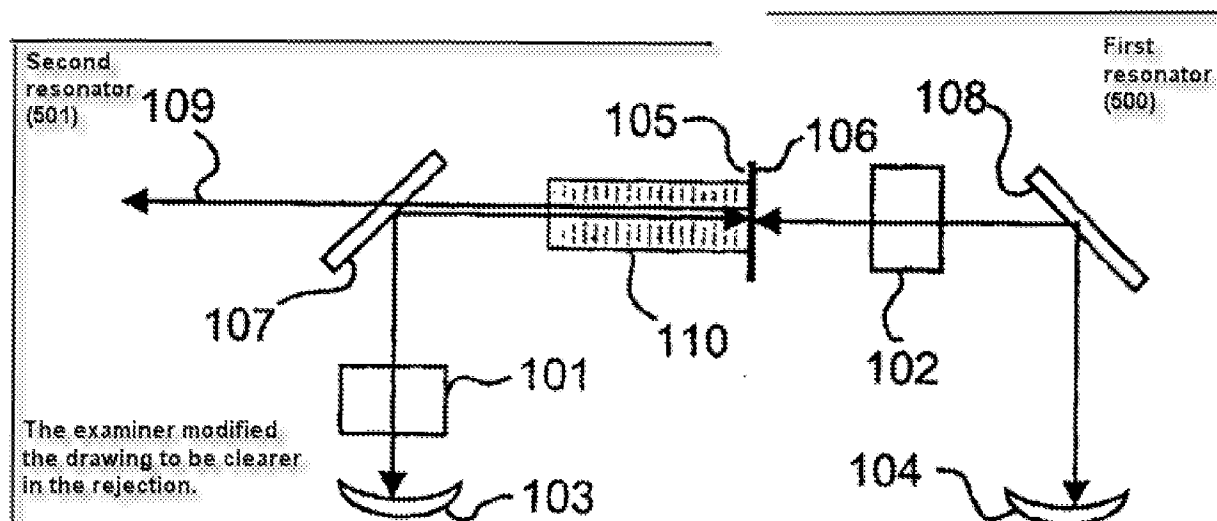
The drawings submitted on 06/25/2007 have been considered by the examiner.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3 – 7, 9, 11, rejected under 35 U.S.C. 103(a) as being unpatentable over Spiekermann (WO 02/103863) in views of Wu et al (5,278,852).



**Regarding claim 1**, Spiekermann shown on Figure 1, discloses a laser arrangement, comprising: a first resonant laser cavity (500); a first optically pumpable gain element (102) located within said first cavity (500) for generation of a first fundamental wavelength; a second resonant laser cavity (501); a pump source (page 6,

lines 21 – 28 and Page 12, lines 34 – 36) arranged to optically pump gain element (101 and 102); a first non-linear optical region (110) arranged for sum-frequency mixing (Page 10, Lines 15 – 37 and Page 11, lines 1 – 10) of the radiation generated in said first resonant cavity (500) and the radiation generated in said second resonant cavity (501).

Spiekermann discloses the claimed invention except for a second non-linear region and second non-linear optical region arranged for frequency doubling. Wu teach a second non-linear region and second non-linear optical region arranged for frequency doubling. However, it is well known in the art to apply second non-linear region and second non-linear optical region arranged for frequency doubling as discloses by Wu in Figure 3, Column 1, Lines 40 – 66 and Column 2, Lines 44 – 48. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was to apply the well known second non-linear region and second non-linear optical region arranged for frequency doubling as suggested by Wu to the laser of Spiekermann, because could be use to operate on the fundamental laser beam present within the resonating cavity (which is one to two orders of magnitude higher than the fundamental beam outside of the cavity). By accessing, and operating on, and fundamental laser beam within the resonating cavity, the frequency conversion efficiency is increased, thereby giving rise to the generation of more powerful harmonic frequencies. The nonlinear crystals are inserted in the laser resonator in order to obtain third, fourth or even higher harmonic output.

There are N nonlinear crystals ( $N \geq 2$ ) between the laser active medium and the

output coupler mirror. Among them, the crystal which is nearest to the laser active medium is a frequency doubling crystal which converts the fundamental wavelength to the second harmonic wavelength. The other crystals act as frequency mixing or frequency doubling devices depending on the desired harmonic to be output. When a nonlinear crystal is inserted in the resonator, the conversion efficiency of the nonlinear process is greatly increased by the intense fundamental laser beam inside the resonator. By this means, the CW high order harmonic output is realized. This method is also applicable in low peak power pulse laser system to further increase the output of the high order harmonic laser beam (see Figure 3, Column 1, Lines 40 – 66 and Column 2, Lines 44 – 48 of WU).

**Regarding claims 3 and 4**, Spiekermann discloses the claimed invention except non-linear optical regions comprises a quasi-phasematching grating (Page 6, lines 29 – 37 and Page 7, lines 1 – 32).

**Regarding claim 5**, Spiekermann discloses a gain elements (101 and 102) is an optically pumpable semiconductor element (Page 6, lines 21 – 28 and Page 12, lines 34 – 36).

**Regarding claims 6 and 7**, Spiekermann discloses a gain elements is an Nd-doped solid-state element selected from Nd:YVO<sub>4</sub>, Nd:YAG, Nd:YLF, Nd:GVO.sub.4, and Nd:Glass (page 9, table 1 and lines 4 - 22) .

**Regarding claims 9 and 11**, Spiekermann discloses non-linear optical region are constituted by a periodically poled crystal of KTP (Page 13, Lines 13 – 21).

Claims 10, 13 – 17 and 19 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spiekermann (WO 02/103863) in views of Wu et al (5,278,852) further in view of Byer et al. (4,739,507).

**Regarding claims 10, 13 – 17 and 19 – 20** Spiekermann discloses the claimed invention except dielectric coating. Byer teach a dielectric coating. However, it is well known in the art to apply dielectric coating as discloses by Byer in Column 3, Lines 31 - 56. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was to apply the well known dielectric coating as suggested by Byer to the laser of Spiekermann because could be use that material can provide a reflectivity greater than 99.5 % , (see Column 3, Lines 31 – 56 of Byer).

#### ***Allowable Subject Matter***

Claims 2 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 2 and 12 are recites a laser

including beam splitter, being located between pump source and gain mediums, *such that pump radiation by the pump source passes by beam splitter before entering the gain medium*, which is neither anticipated or disclosed nor suggested in any piece of available prior art, which is neither anticipated nor obvious over the prior art of record.

### ***Response to Arguments***

Applicant's arguments filed April 23, 2008 have been fully considered but they are not persuasive. Applicant's election with traverse of species in the reply filed on April 23, 2008 is acknowledged. The traversal is on the ground(s) that "third non-linear optical region" which is not shown in the drawing. This is not found persuasive because need another search and is another embodiment. The requirement is still deemed proper and is therefore made FINAL.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Delma R. Fordé whose telephone number is (571) 272-1940. The examiner can normally be reached on M - F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Min Sun Harvey can be reached on (571) -272-1835. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Delma R. Fordé/

Examiner, Art Unit 2828

/Minsun Harvey/

Supervisory Patent Examiner, Art Unit 2828